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Publication No. JP 10-313,566
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Application No. 09-120830

Begin Translation:

CLAIMS

[Claim(s)]
[Claim 1] The linear motor which makes the aforementioned permanent magnet the shape of a tubed basic form in the linear motor which has the stator section which combines in series and changes so that an opposite magnetic pole may counter two or more permanent magnets mutually, and is characterized by constituting the aforementioned stator section as between the permanent magnets which adjoin each other by inserting the pin center,large shaft by the non-magnetic material in these, and binding tight from both sides was stuck.
[Claim 2] The linear motor characterized by covering the periphery side of two or more aforementioned permanent magnets with the tube-like object by the non-magnetic material in a linear motor according to claim 1.
[Claim 3] The linear motor characterized by forming a male screw in the end side of the aforementioned pin center,large shaft, thrusting into a bracket, forming a male screw also in an other end side in a linear motor according to claim 2 covering predetermined length, equipping the male screw by the side of this other end with a nut, and making it stick between two or more aforementioned permanent magnets between the aforementioned brackets.
[Claim 4] It is the linear motor which the aforementioned permanent magnet is a ring-like in a linear motor according to claim 3, and is characterized by the aforementioned tube-like object being the pipe of the cross-section round shape in which adhesion fitting on the periphery of the aforementioned permanent magnet is possible.
[Claim 5] It is the linear motor characterized by the aforementioned permanent magnet consisting of rare earth or ferrite system magnet material in a linear motor according to claim 4.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to improvement of the stator especially constituted combining two or more permanent magnets about a linear motor.

[0002]
[Description of the Prior Art] Using a linear motor for the part as which straight-line movement is required like a print head in the field of OA equipment recently is proposed. Usually, the linear motor has the stator section which combines in series and changes so that an opposite magnetic pole may counter two or more permanent magnets mutually, and the moving part which is arranged so that this may be surrounded on the outside of this stator section, and contains the coil which can be slid to the shaft orientations of the stator section. By passing current in a coil so that the magnetic flux generated with a permanent magnet may be intersected, based on the interaction of this current and magnetic field, driving force occurs in shaft orientations at the coil section, consequently moving part moves.
[0003] In such a linear motor, the assembly precision of two or more permanent magnets which can be set in the stator section influences the positioning accuracy of moving part. Until now, two or more permanent magnets are attached to cylindrical supporter material by adhesion, and explain this with reference to drawing 5 .
[0004] In drawing 5 , it pastes up in series and the stator section 40 is constituted so that an opposite magnetic pole may counter mutually the both sides of the cylindrical supporter material 41 which consists of a non-magnetic material in the permanent magnet 42 of two or more letters of a block. In for OA equipment, such the stator section 40 is [the overall length of the length of a permanent magnet 42] less than 1m in about several cm. For this reason, it is necessary to paste up dozens of or more permanent magnets 42 on the supporter material 41.
[0005]
[Problem(s) to be Solved by the Invention] Since big repulsive force acts between the adjacent permanent magnets 42 in case the above adhesion is performed, you have to keep time until adhesives solidify in the state where the permanent magnet 42 was held with the fixture. For this reason, the manufacturing process of the stator section 40 not only needs the time for solidifying adhesives, but had the problem of being easy to produce a position gap of a permanent magnet.
[0006] Then, the technical problem of this invention is to offer the linear motor equipped with the stator section which attached the permanent magnet without adhesion.
[0007] Other technical problems of this invention are to offer the linear motor equipped with the stator section which attached the permanent magnet with high positioning accuracy.
[0008] The technical problem of further others of this invention has assembly in offering the linear motor equipped with the easy and cheap stator section.
[0009]
[Means for Solving the Problem] The linear motor characterized by constituting the aforementioned stator section as between the permanent magnets which adjoin each other by according to this invention making the aforementioned permanent magnet into the shape of a tubed basic form in the linear motor which has the stator section which combines in series and changes so that an opposite magnetic pole may counter two or more permanent magnets mutually, inserting the pin center,large shaft by the non-magnetic material in these, and binding tight from both sides was stuck is offered.
[0010] In addition, it is desirable to cover the periphery side of two or more aforementioned permanent magnets with the tube-like object by the non-magnetic material.
[0011] Moreover, it is desirable to form a male screw in the end side of the aforementioned pin center,large shaft, to thrust into a bracket, to form a male screw also in an other end side covering predetermined length, to equip the male screw by the side of this other end with a nut, and to stick between two or more aforementioned permanent magnets between the

aforementioned brackets.
[0012] Furthermore, the aforementioned permanent magnet is a ring-like and, as for the aforementioned tube-like object, it is desirable that it is the pipe of the cross-section round shape in which adhesion fitting on the periphery of the aforementioned permanent magnet is possible.
[0013] As for the aforementioned permanent magnet, it is desirable to consist of rare earth or ferrite system magnet material.
[0014]
[Embodiments of the Invention] Below, the gestalt of desirable operation of this invention is explained. With reference to drawing 2 , the linear motor in this gestalt has the stator section 10 and moving part 20. The stator section 10 has the bracket 11 by the non-magnetic material, and the pipe 12 by the non-magnetic material having many permanent magnets so that it may explain in detail later. Moving part 20 has two or more coils 21 (here 12 pieces), as shown in drawing 3 (a), and a pipe 12 penetrates the coil 21 of these plurality. The slide to the shaft orientations of a pipe 12 of moving part 20 is attained in the state of contact or non-contact at the pipe 12. In addition, the AC power supply of a three phase circuit is connected to 12 coils 21, and as each coil 21 shows each phases W, U, and V at drawing 3 (b), it connects with them.
[0015] With reference to drawing 1 , the stator section 10 which is the feature of this gestalt is explained. In addition to a bracket 11 and a pipe 12, the stator section 10 has the pin center,large shaft 14 by the non-magnetic material inserted in the permanent magnet 13 of the shape of two or more ring, and two or more permanent magnets 13, and the nut 15 for bolting. It is thrust into the female screw section which the male screw 14-1 was formed in the end side of the pin center,large shaft 14, and was formed in the bracket 11. The male screw 14-2 covering predetermined length which ****s, carries out and has ** is formed also in the other end side of the pin center,large shaft 14, a nut 15 is screwed in this male screw 14-2, and it is made to stick between two or more permanent magnets 13 between a bracket 11 and a nut 15. Two or more permanent magnets 13 are together put in series so that an opposite magnetic pole may counter mutually, and it is made to cover the periphery side of the permanent magnet 13 of these plurality in the pipe 12 of a cross-section round shape. In addition, the hole 11-1 for the screw-thread insertion for attaching the stator section 10 in the device by which a linear motor is mounted is formed in the bracket 11.
[0016] Although the large rare earth or ferrite system material of flux density is desirable as a material of a permanent magnet 13, other magnet material is sufficient. As a material of a pipe 12, a non-magnetic material like stainless steel is used as a material of the pin center,large shaft 14 that what is necessary is just non-magnetic materials, such as aluminum, brass, and stainless steel. Especially the pin center,large shaft 14 is designed so that a mechanical strength required for the assembly of a permanent magnet 13 may be obtained. On the other hand, the thinner one is desirable as it can avoid decreasing the magnetic field which acts on the moving part 20 arranged on the outside about a pipe 12. A pipe 12 is realized by stainless steel with a thickness of 1mm as an example. Moreover, a pipe 12 also has the function which guides this moving part 20, when moving part 20 is a contact process, while having the bore which will be in the periphery section and the adhesion state of a permanent magnet 13 and having a rustproof function of a permanent magnet 13.
[0017] An example of the assembly method of this stator section 10 is explained. The male screw 14-1 of the pin center,large shaft 14 is thrust into a bracket 11. Next, a pipe 12 is arranged around the pin center,large shaft 14, and it inserts one permanent magnet 13 at a time into a pipe 12 through the pin center,large shaft 14. If the permanent magnet 13 of the predetermined number is put in, a nut 15 will be screwed in a male screw 14-2, and it will

bind tight so that between permanent magnets 13 may stick. In addition, although it is necessary to turn a nut 15 within a pipe 12 when the length of a pipe 12 is longer than the length when attaching the permanent magnet 13 of the predetermined number like drawing 1 , this is performed using a special fixture. After attaching a permanent magnet 13, opening of a pipe 12 is closed by the cap 16.

[0018] For reference, the permanent magnet 13 with the outer diameter of 36.3mm, a bore [of 16.3mm], and a length of 60mm is used for drawing 4 , and flux density (Y= 20mm of distance from a medial axis, 25mm, and 30mm) of an actual measurement is shown in it. There is nothing until it says, and the flux density in the joint of two permanent magnets 13 shows peak value.

[0019] The stator section by this gestalt is realizable to a length of about about 2m. In addition, the shape not only of the shape of a ring but a polygon has as the configuration of a permanent magnet 13, and it is made into the cross-section configuration same as a pipe 12 in this case. Moreover, the linear motor by this gestalt is applicable not only to a comparatively small thing like OA equipment but the part as which straight-line movement is required in a large-scale industrial machine as shown in the move table in a large-sized machine tool like a milling machine.

[0020]

[Effect of the Invention] As explained above, according to this invention, the following effects are acquired, when two or more permanent magnets for constituting the stator section of a linear motor are attached without an adhesion process and were made to be made.

[0021] ** Since two or more permanent magnets are attached and are made only in bolting, structure and a linear motor easy [attachment work] and cheap can be offered.

[0022] ** Since the adhesion process is unnecessary, time until the special fixture and special adhesives for holding a permanent magnet on the occasion of adhesion solidify can attach by being unnecessary in a short time.

[0023] ** Since the position gap between two or more permanent magnets does not arise; a permanent magnet can be arranged as a design value, consequently the positioning accuracy of moving part can be raised.

TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to improvement of the stator especially constituted combining two or more permanent magnets about a linear motor.

PRIOR ART

[Description of the Prior Art] Using a linear motor for the part as which straight-line movement is required like a print head in the field of OA equipment recently is proposed. Usually, the linear motor has the stator section which combines in series and changes so that an opposite magnetic pole may counter two or more permanent magnets mutually, and the moving part which is arranged so that this may be surrounded on the outside of this stator section, and contains the coil which can be slid to the shaft orientations of the stator section. By passing current in a coil so that the magnetic flux generated with a permanent magnet may be intersected, based on the interaction of this current and magnetic field,

driving force occurs in shaft orientations at the coil section, consequently moving part moves.

[0003] In such a linear motor, the assembly precision of two or more permanent magnets which can be set in the stator section influences the positioning accuracy of moving part. Until now, two or more permanent magnets are attached to cylindrical supporter material by adhesion, and explain this with reference to drawing 5 .

[0004] In drawing 5 , it pastes up in series and the stator section 40 is constituted so that an opposite magnetic pole may counter mutually the both sides of the cylindrical supporter material 41 which consists of a non-magnetic material in the permanent magnet 42 of two or more letters of a block. In for OA equipment, such the stator section 40 is [the overall length of the length of a permanent magnet 42] less than 1m in about several cm. For this reason, it is necessary to paste up dozens of or more permanent magnets 42 on the supporter material 41.

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to this invention, the following effects are acquired, when two or more permanent magnets for constituting the stator section of a linear motor are attached without an adhesion process and were made to be made.

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[0023] ** Since the position gap between two or more permanent magnets does not arise, a permanent magnet can be arranged as a design value, consequently the positioning accuracy of moving part can be raised.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Since big repulsive force acts between the adjacent permanent magnets 42 in case the above adhesion is performed, you have to keep time until adhesives solidify in the state where the permanent magnet 42 was held with the fixture. For this reason, the manufacturing process of the stator section 40 not only needs the time for solidifying adhesives, but had the problem of being easy to produce a position gap of a permanent magnet.

[0006] Then, the technical problem of this invention is to offer the linear motor equipped with the stator section which attached the permanent magnet without adhesion.

[0007] Other technical problems of this invention are to offer the linear motor equipped with the stator section which attached the permanent magnet with high positioning accuracy.

[0008] The technical problem of further others of this invention has assembly in offering the linear motor equipped with the easy and cheap stator section.

MEANS

[Means for Solving the Problem] The linear motor characterized by constituting the aforementioned stator section as between the permanent magnets which adjoin each other by according to this invention making the aforementioned permanent magnet into the shape of a tubed basic form in the linear motor which has the stator section which combines in series and changes so that an opposite magnetic pole may counter two or more permanent magnets mutually, inserting the pin center,large shaft by the non-magnetic material in these, and binding tight from both sides was stuck is offered.

[0010] In addition, it is desirable to cover the periphery side of two or more aforementioned permanent magnets with the tube-like object by the non-magnetic material.

[0011] Moreover, it is desirable to form a male screw in the end side of the aforementioned pin center,large shaft, to thrust into a bracket, to form a male screw also in an other end side covering predetermined length, to equip the male screw by the side of this other end with a nut, and to stick between two or more aforementioned permanent magnets between the aforementioned brackets.

[0012] Furthermore, the aforementioned permanent magnet is a ring-like and, as for the aforementioned tube-like object, it is desirable that it is the pipe of the cross-section round shape in which adhesion fitting on the periphery of the aforementioned permanent magnet is possible.

[0013] As for the aforementioned permanent magnet, it is desirable to consist of rare earth or ferrite system magnet material.

[0014]

[Embodiments of the Invention] Below, the gestalt of desirable operation of this invention is explained. With reference to drawing 2 , the linear motor in this gestalt has the stator section 10 and moving part 20. The stator section 10 has the bracket 11 by the non-magnetic material, and the pipe 12 by the non-magnetic material having many permanent magnets so that it may explain in detail later. Moving part 20 has two or more coils 21 (here 12 pieces), as shown in drawing 3 (a), and a pipe 12 penetrates the coil 21 of these plurality. The slide to the shaft orientations of a pipe 12 of moving part 20 is attained in the state of contact or non-contact at the pipe 12. In addition, the AC power supply of a three phase circuit is connected to 12 coils 21, and as each coil 21 shows each phases W, U, and V at drawing 3 (b), it connects with them.

[0015] With reference to drawing 1 , the stator section 10 which is the feature of this gestalt is explained. In addition to a bracket 11 and a pipe 12, the stator section 10 has the pin center,large shaft 14 by the non-magnetic material inserted in the permanent magnet 13 of the shape of two or more ring, and two or more permanent magnets 13, and the nut 15 for bolting. It is thrust into the female screw section which the male screw 14-1 was formed in the end side of the pin center,large shaft 14, and was formed in the bracket 11. The male screw 14-2 covering predetermined length which ****s, carries out and has ** is formed also in the other end side of the pin center,large shaft 14, a nut 15 is screwed in this male screw 14-2, and it is made to stick between two or more permanent magnets 13 between a bracket 11 and a nut 15. Two or more permanent magnets 13 are together put in series so that an opposite magnetic pole may counter mutually, and it is made to cover the periphery side of the permanent magnet 13 of these plurality in the pipe 12 of a cross-section round shape. In addition, the hole 11-1 for the screw-thread insertion for attaching the stator section 10 in the device by which a linear motor is mounted is formed in the bracket 11.

[0016] Although the large rare earth or ferrite system material of flux density is desirable as a material of a permanent magnet 13, other magnet material is sufficient. As a material of a pipe 12, a non-magnetic material like stainless steel is used as a material of the pin

center,large shaft 14 that what is necessary is just non-magnetic materials, such as aluminum, brass, and stainless steel. Especially the pin center,large shaft 14 is designed so that a mechanical strength required for the assembly of a permanent magnet 13 may be obtained. On the other hand, the thinner one is desirable as it can avoid decreasing the magnetic field which acts on the moving part 20 arranged on the outside about a pipe 12. A pipe 12 is realized by stainless steel with a thickness of 1mm as an example. Moreover, a pipe 12 also has the function which guides this moving part 20, when moving part 20 is a contact process, while having the bore which will be in the periphery section and the adhesion state of a permanent magnet 13 and having a rustproof function of a permanent magnet 13.

[0017] An example of the assembly method of this stator section 10 is explained. The male screw 14-1 of the pin center,large shaft 14 is thrust into a bracket 11. Next, a pipe 12 is arranged around the pin center,large shaft 14, and it inserts one permanent magnet 13 at a time into a pipe 12 through the pin center,large shaft 14. If the permanent magnet 13 of the predetermined number is put in, a nut 15 will be screwed in a male screw 14-2, and it will bind tight so that between permanent magnets 13 may stick. In addition, although it is necessary to turn a nut 15 within a pipe 12 when the length of a pipe 12 is longer than the length when attaching the permanent magnet 13 of the predetermined number like drawing 1 , this is performed using a special fixture. After attaching a permanent magnet 13, opening of a pipe 12 is closed by the cap 16.

[0018] For reference, the permanent magnet 13 with the outer diameter of 36.3mm, a bore [of 16.3mm], and a length of 60mm is used for drawing 4 , and flux density (Y= 20mm of distance from a medial axis, 25mm, and 30mm) of an actual measurement is shown in it. There is nothing until it says, and the flux density in the joint of two permanent magnets 13 shows peak value.

[0019] The stator section by this gestalt is realizable to a length of about about 2m. In addition, the shape not only of the shape of a ring but a polygon has as the configuration of a permanent magnet 13, and it is made into the cross-section configuration same as a pipe 12 in this case. Moreover, the linear motor by this gestalt is applicable not only to a comparatively small thing like OA equipment but the part as which straight-line movement is required in a large-scale industrial machine as shown in the move table in a large-sized machine tool like a milling machine.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the cross section showing the structure of the stator section of the linear motor by the gestalt of desirable operation of this invention.

[Drawing 2] It is drawing having shown the appearance of the linear motor by the gestalt of desirable operation of this invention, and drawing (a) is [front view and drawing (c) of a plan and drawing (b)] side elevations.

[Drawing 3] It is drawing for explaining the moving part in drawing 2 , and is drawing in which drawing's (a's)'s having shown the side elevation and having shown an example of the topology of two or more coils of drawing (a) (b).

[Drawing 4] It is drawing having shown the survey result of the flux density by the stator section shown in drawing 1 .

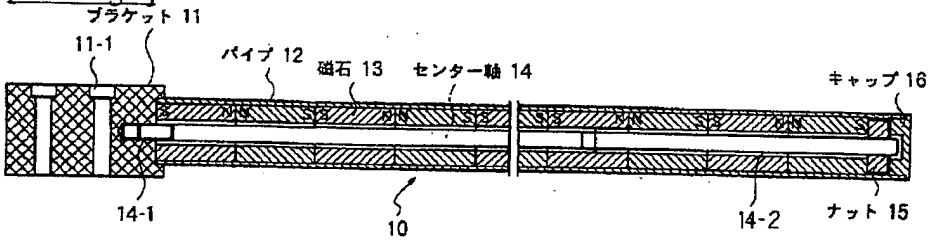
[Drawing 5] It is drawing having shown the starter section in the conventional linear motor roughly.

[Description of Notations]

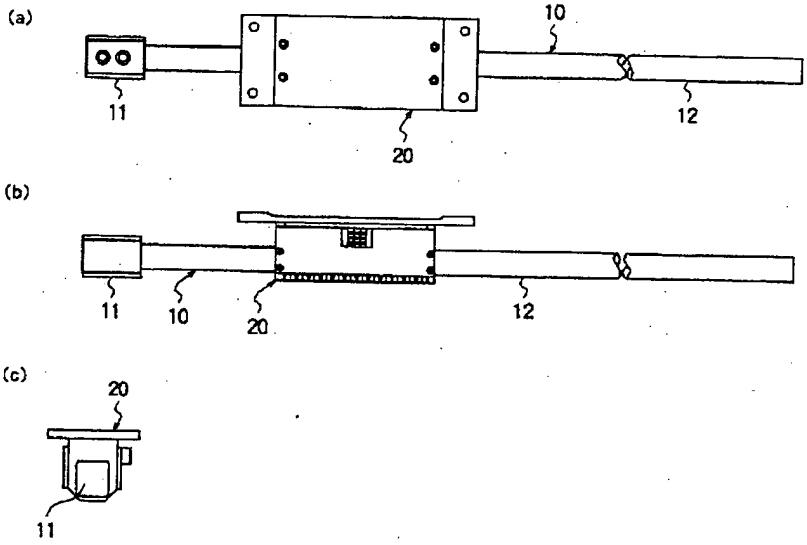
10 Stator Section
11 Bracket
12 Pipe
13 Permanent Magnet
14 Pin Center,large Shaft
14-1, 14-2 Male screw
15 Nut
16 Cap
20 Moving Part
21 Coil

DRAWINGS

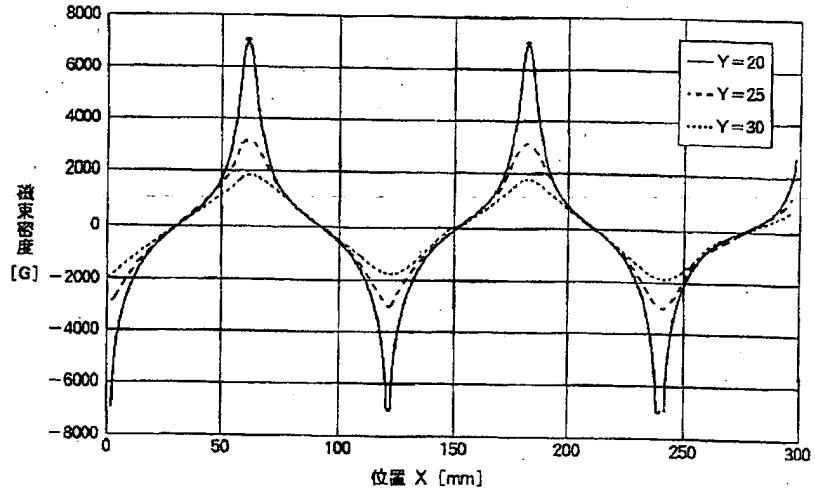
[Drawing 1]



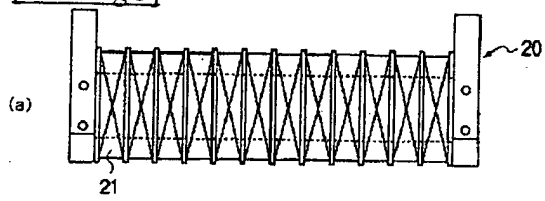
[Drawing 2]

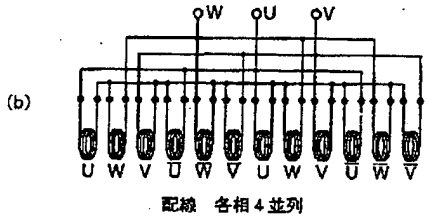


[Drawing 4]

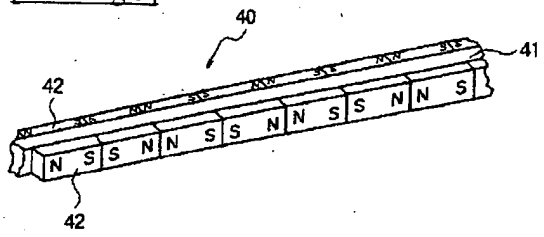


[Drawing 3]





[Drawing 5]



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Ｈ０２Ｋ　41/03		Ｈ０２Ｋ　41/03	Ａ

審査請求　未請求　請求項の数５　ＯＬ　（全５頁）

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(22)出願日　平成９年(1997)５月12日

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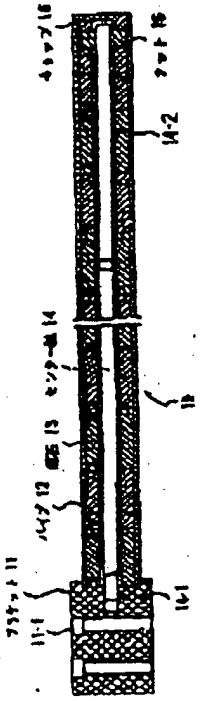
(54)【発明の名称】　リニアモータ

(57)【要約】
【課題】　永久磁石を接着無しで組み付けたステータ部を備えたリニアモータを提供すること。
【解決手段】　永久磁石１３を帯状とし、これらに非磁性材料によるセンター軸１４を挿入して両側から締め付けることにより隣り合う永久磁石の間を密着させるようにしてステータ部１０を構成した。



【特許請求の範囲】

【請求項１】　複数の永久磁石を互いに反対の磁極が対向するように直列に組み合わせて成るステータ部を有するリニアモータにおいて、前記永久磁石を筒状の基本形状とし、これらに非磁性材料によるセンター軸を挿入して両側から締め付けることにより隣り合う永久磁石の間を密着させるようにして前記ステータ部を構成したことを特徴とするリニアモータ。

【請求項２】　請求項１記載のリニアモータにおいて、前記複数の永久磁石の外周側を非磁性材料による筒状体で覆うようにしたことを特徴とするリニアモータ。

【請求項３】　請求項２記載のリニアモータにおいて、前記センター軸の一端側におねじを形成してブラケットに挿入し、他端側にも所定の長さにわたっておねじを形成し、該他端側のおねじにはナットを螺着して前記ブラケットとの間で前記複数の永久磁石の間を密着させるようにしたことを特徴とするリニアモータ。

【請求項４】　請求項３記載のリニアモータにおいて、前記永久磁石はリング状であり、前記筒状体は前記永久磁石の外周に密着嵌合可能な断面円形のパイプであることを特徴とするリニアモータ。

【請求項５】　請求項４記載のリニアモータにおいて、前記永久磁石は、希土類またはフェライト系磁石材料から成ることを特徴とするリニアモータ。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明はリニアモータに関し、特に複数の永久磁石を組み合わせて構成されるステータの改良に関する。

【０００２】

【従来の技術】最近、ＯＡ機器の分野において、例えば印字ヘッドのように直線移動が要求される部位に、リニアモータを利用することが提案されている。通常、リニアモータは、複数の永久磁石を互いに反対の磁極が対向するように直列に組み合わせて成るステータ部と、このステータ部の外側にこれを囲むように配置され、ステータ部の軸方向にスライド可能なコイルを含む可動部とを有している。永久磁石で発生される磁束と交叉するようにコイルに電流を流すことにより、この電流と磁界との相互作用に基づいてコイル部には軸方向に起動力が発生し、その結果、可動部が移動する。

【０００３】このようなリニアモータにおいては、ステータ部における複数の永久磁石の組立精度が可動部の位置決め精度を左右する。これまで、複数の永久磁石は棒状の支持部材に接着により組み付けられており、これを図５を参照して説明する。

【０００４】図５において、ステータ部４０は、非磁性材料より成る棒状の支持部材４１の両側に、複数のブロック状の永久磁石４２を互いに反対の磁極が対向するように直列に接着して構成されている。このようなステータ部４０は、ＯＡ機器用の場合、永久磁石４２の長さは数ｃｍ程度で、全長は１ｍ以内である。このため、数十個以上の永久磁石４２を支持部材４１に接着する必要がある。

【０００５】

【発明が解決しようとする課題】上記のような接着を行う際には、隣り合う永久磁石４３の間に大きな反発力が作用するので、接着剤が固化するまでの時間は永久磁石４２を治具で保持した状態に置かなければならない。このため、ステータ部４０の製造工程は接着剤を固化させるための時間を必要とするだけでなく、永久磁石の位置ずれが生じ易いという問題があった。

【０００６】そこで、本発明の課題は、永久磁石を接着無しで組み付けたステータ部を備えたリニアモータを提供することにある。

【０００７】本発明の他の課題は、永久磁石を高い位置決め精度で組み付けたステータ部を備えたリニアモータを提供することにある。

【０００８】本発明の更に他の課題は、組立が容易で安価なステータ部を備えたリニアモータを提供することにある。

【０００９】

【課題を解決するための手段】本発明によれば、複数の永久磁石を互いに反対の磁極が対向するように直列に組み合わせて成るステータ部を有するリニアモータにおいて、前記永久磁石を筒状の基本形状とし、これらに非磁性材料によるセンター軸を挿入して両側から締め付けることにより隣り合う永久磁石の間を密着させるようにして前記ステータ部を構成したことを特徴とするリニアモータが提供される。

【００１０】なお、前記複数の永久磁石の外周側を非磁性材料による筒状体で覆うことが好ましい。

【００１１】また、前記センター軸の一端側におねじを形成してブラケットに挿入し、他端側にも所定の長さにわたっておねじを形成し、該他端側のおねじにはナットを螺着して前記ブラケットとの間で前記複数の永久磁石の間を密着させることが好ましい。

【００１２】更に、前記永久磁石はリング状であり、前記筒状体は前記永久磁石の外周に密着嵌合可能な断面円形のパイプであることが好ましい。

【００１３】前記永久磁石は、希土類またはフェライト系磁石材料から成ることが好ましい。

【００１４】

【発明の実施の形態】以下に、本発明の好ましい実施の形態について説明する。図２を参照して、本形態におけるリニアモータは、ステータ部１０と可動部２０とを有する。ステータ部１０は、後で詳しく説明するように、非磁性材料によるブラケット１１と多数の永久磁石を内蔵した非磁性材料によるパイプ１２とを有する。可動部２０は、図３（ａ）に示すように、複数のコイルＣ１

（ここでは１２個）を有し、これら複数のコイル２１をパイプ１２が貫通する。可動部２０はパイプ１２に接触あるいは非接触状態でパイプ１２の軸方向にスライド可能になっている。なお、１２個のコイル２１には、３相の交流電源が接続され、各相Ｗ、Ｕ、Ｖには各コイル２１が図３（ｂ）に示すように接続される。

【００１５】図１を参照して、本形態の特徴であるステータ部１０について説明する。ステータ部１０は、ブラケット１１、パイプ１２に加えて、複数のリング状の永久磁石１３と、複数の永久磁石１３に挿入された非磁性材料によるセンター軸１４と、締め付け用のナット１５とを有する。センター軸１４の一端側にはおねじ１４－１が形成され、ブラケット１１に形成されためねじ部に螺入されている。センター軸１４の他端側にも所定の長さにわたるねじしろを持つおねじ１４－２が形成され、このおねじ１４－２にナット１５が螺合されてブラケット１１とナット１５との間で複数の永久磁石１３の間を密着させるようにしている。複数の永久磁石１３は、互いに反対の磁極が対向するように直列に組み合わされ、これら複数の永久磁石１３の外周側を断面円形のパイプ１２で覆うようにしている。なお、ブラケット１１には、ステータ部１０を、リニアモータが実装される機器に取り付けるためのねじ挿通用の孔１１－１が設けられている。

【００１６】永久磁石１３の材料としては、磁束密度の大きい希土類またはフェライト系材料が好ましいが他の磁石材料でも良い。パイプ１２の材料としては、アルミニウム、真鍮、ステンレス等の非磁性材料であれば良く、センター軸１４の材料としては、ステンレスのような非磁性材料が使用される。特に、センター軸１４は、永久磁石１３の組立に必要な機械的強度が得られるように設計される。一方、パイプ１２に関しては、その外側に配置される可動部２０に作用する磁界を減少させないようにできるだけ薄い方が好ましい。一例として、パイプ１２は厚さ１ｍｍのステンレスで実現される。また、パイプ１２は、永久磁石１３の外周部と密着状態になる内径を有して永久磁石１３の防錆の機能を有すると共に、可動部２０が接触式の場合には、この可動部２０をガイドする機能をも有する。

【００１７】このステータ部１０の組立方法の一例を説明する。センター軸１４のおねじ１４－１をブラケット１１に螺入する。次に、パイプ１２をセンター軸１４の周囲に配設し、永久磁石１３を１個ずつセンター軸１４を通してパイプ１２内に挿入する。所定個数の永久磁石１３を入れたら、ナット１５をおねじ１４－２に螺合し、永久磁石１３間が密着するように締め付ける。なお、図１のように、パイプ１２の長さが、所定個数の永久磁石１３を組み付けた時の長さよりも長い場合には、ナット１６をパイプ１２内で回す必要があるが、これは特別な治具を用いて行われる。永久磁石１３を組み付けた後、パイプ１２の開口はキャップ１６で塞がれる。

【００１８】図４には、参考のために、外径３６．３ｍｍ、内径１６．３ｍｍ、長さ６０ｍｍの永久磁石１３を用い、中心軸からの距離Ｙ＝２０ｍｍ、２５ｍｍ、３０ｍｍでの磁束密度の実測値を示す。言うまでも無く、２つの永久磁石１３の接合部での磁束密度がピーク値を示す。

【００１９】本形態によるステータ部は、長さ約２ｍ程度まで実現できる。なお、永久磁石１３の形状は、リング状に限らず多角形状でも良く、この場合パイプ１２も同じ断面形状にされる。また、本形態によるリニアモータは、ＯＡ機器のような比較的小型のものに限らず、例えばプライス盤のような大型工作機械における移動テーブルのような大型産業機械において直線移動が要求される部位にも適用可能である。

【００２０】

【発明の効果】以上説明してきたように、本発明によれば、リニアモータのステータ部を構成するための複数の永久磁石を接着工程無しで組み付けできるようにしたこ
複数の永久磁石を締め付けだけで組み付
けできるので、構造及び組付け作業が簡単で安価なリニ
接着工程が不要であるので、接着に限し
て永久磁石を保持するための特殊な治具及び接着剤が固化するまでの時間が不要であり、組み付けを短時間で行
複数の永久磁石間の位置ずれが生じない
ので、永久磁石を設計値通りに配置でき、その結果、可動部の位置決め精度を向上させることができる。

【図面の簡単な説明】

【図１】本発明の好ましい実施の形態によるリニアモータのステータ部の構造を示す断面図である。

【図２】本発明の好ましい実施の形態によるリニアモータの外観を示した図であり、図（ａ）は平面図、図（ｂ）は正面図、図（ｃ）は側面図である。

【図３】図２における可動部を説明するための図で、図（ａ）は側面図、図（ｂ）は図（ａ）の複数のコイルの接続形態の一例を示した図である。

【図４】図１に示されたステータ部による磁束密度の実測結果を示した図である。

【図５】従来のリニアモータにおけるスタータ部を概略的に示した図である。

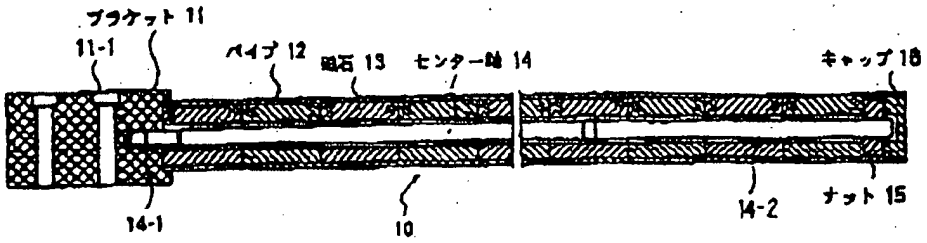
【符号の説明】

１０　ステータ部
１１　ブラケット
１２　パイプ
１３　永久磁石
１４　センター軸
１４－１、１４－２　おねじ

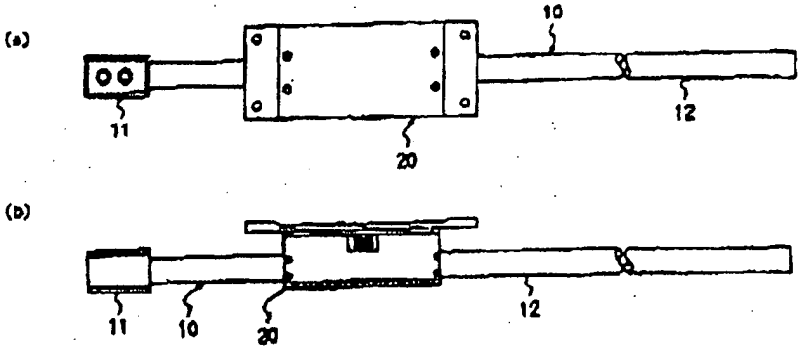
15　ナット
16　キャップ

20　可動部
21　コイル

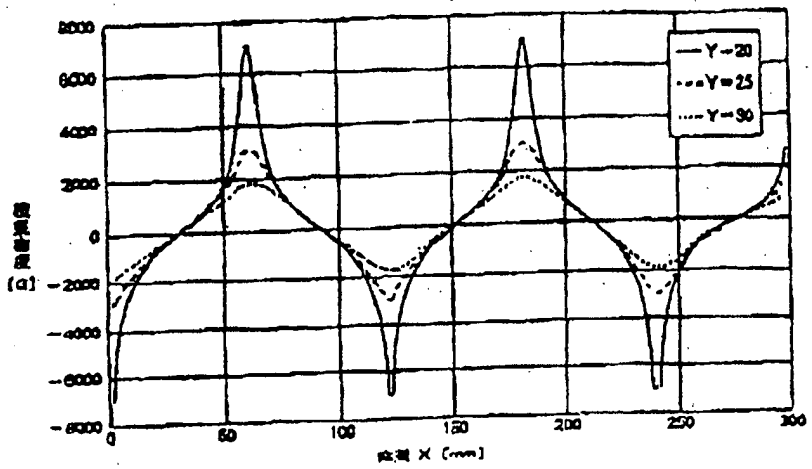
【図1】



【図2】



【図4】



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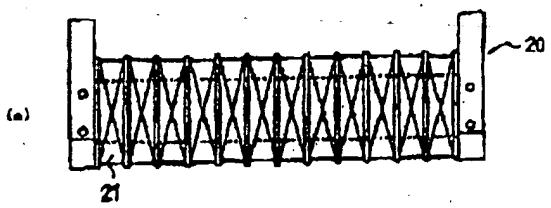
【図3】



【図5】